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Green Heat.

Volume 1.

Why urgent supporting action should be taken in the UK, and how that should be done.

by

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A report to Summerleaze Ltd.

Summary.

Mankind will very soon have to face two serious problems that are increasingly receiving recognition. First, supplies of low-cost fuels (mainly oil) are beginning to diminish; this will have serious effects on the global economy and, unless the transition to the new reality is managed carefully, there could also be damage to political stability.

Secondly, the threat of the damaging effects of climate-change caused by the emissions of gases resulting from the combustion of fossil carbonaceous fuels is now widely accepted. Furthermore, estimates made by reputable scientists of the likely pace and scale of that threat are growing in magnitude. To deal with it, international co-operation is urgently needed on the political front, and the first faltering steps have been taken, such as the Kyoto Protocol.

Most of the uses of fossil fuels can be usefully split into three:

(a) fuels (solids, liquids and gases) for generating electricity;
(b) fuels (mainly liquids) for transport;
(c) fuels (solids, liquids and gases) for heat without associated generation of electricity.

The rate of use of fossil fuels must be greatly reduced, and it is widely agreed that an important part of the strategy to achieve that is the development of both energy-saving measures and *"energy from renewable sources"*. In this report, explanations are given for why, among choices within renewable energy, Green Heat offers the best value for financial support, and why the market for Green Heat has developed very slowly so far in the UK. The position in other European countries is then summarised.

Finally, options for change are analysed and recommendations are made. The principal findings are that the Climate Change Levy should be amended to cover (a) all fossil fuels, (b) for all uses, and (c) by all customers, and that some of the extra revenues should be recycled to tax-payers through the Council-Tax and Business-Rate mechanisms. Special arrangements should be made to secure the interests of the fuel-poor.

Contents.

1. INTRODUCTION.

Throughout this document, extensive references are made to European, as well as to UK, laws, policies and practices. This is because (a) Green Energy* is well established in some other European countries, which are ready to transfer technologies here, and (b) the European Union (EU) and its Commission (EC) have formulated several relevant measures for supporting Green Energy that are binding on the Member States (MS). In contrast, the UK has yet to make much progress in this field, and to develop its markets (including the export of technology and knowledge).

*Note: * In Eurospeak, the accepted terminology is "energy from renewable sources" but in this report it is called "Green Energy", within which can be found the sub-categories of "Green Electricity" and "Green Heat", for example. "Brown Energy" means energy from fossil fuels.*

In the year 2000, within the fifteen MS that, until recently, comprised the EU, oil contributed about 38 per cent of the energy consumed, natural gas - about 23 per cent, nuclear power - 14 per cent, solid fossil fuels (coal, lignite, etc.) - about 18 per cent and renewable energy about 6 per cent (EC, 2004). Most of the uses of solid, liquid and gaseous fossil-carbonaceous and nuclear fuels can usefully be split into three classes that, for the purposes of this paper, can be assumed to be roughly equal in scale in the UK:

(a) fuels for generating electricity*;
(b) fuels for transport;
(c) fuels for heating without an associated generation of electricity.

*Note: *At present, only 2.4 per cent of the electricity used in the UK comes from the sources of Green Electricity that are eligible under the Renewables Obligation – see below. Another 1.5 per cent comes from large-scale hydro-power stations.*

For the reasons summarised in Section 2, it is widely agreed that much more political emphasis than has been applied in the past must now be given to energy-efficiency (i.e. cutting out wasteful uses, and using less energy to achieve particular purposes), and to renewable energy.

In Section 3, consideration is given to the reasons why the market for Green Heat has developed very slowly in the UK. Against this background, an explanation is given in Section 4 of why, among choices within renewable energy, Green Heat offers the best value for financial support

The position in other European countries is summarised in Section 5 and, in more detail, in Volume 2. In Section 6, options for change are analysed and recommendations are made.

2. BACKGROUND INFORMATION.

According to several authoritative researchers, mankind will very soon have to face two serious problems that have been on the political agenda for years, but which have not been accorded their due priority. First, there are clear signs that supplies of low-cost fossil fuels (mainly oil) are beginning to diminish (Campbell, 2003*); this will lead to serious effects on the global economy and, unless the transition to the new reality is managed carefully, there could also be damage to political stability.

*Note: * when researchers publish their results, this often encourages others to publish contrary views. Odell (2004) has recently stated "… plentiful natural gas resources … can readily sustain most of the total potential energy supply required until the very last decade of the 21st century …" But several other authors of recent publications support Campbell's analysis.*

Secondly, the threat of the damaging effects of climate-change caused by the emissions of gases resulting from the combustion of fossil carbonaceous fuels is now widely accepted. Furthermore, estimates made by reputable scientists of the likely pace and scale of that threat are growing in magnitude. To deal with it, international co-operation is urgently needed on the political front, and the first faltering steps have been taken, such as the Kyoto Protocol. The EU has adopted a more positive stance than some other large countries, for example Russia, which has only recently signed the Protocol, and the USA, which still has not done so; under the Protocol, less-developed countries like China and India are not required to take actions.

In 1997, the EU set a target for the rapid development of Green Energy (all energy used for electricity, transport and heating), requiring it to reach 12 per cent of total inland energy-consumption by 2010. The actions taken by the EU towards achieving that target include support for energy-efficiency, Green Electricity and liquid biofuels for transport. There is as yet, however, no general European measure to support Green Heat, although some European countries are bringing in such measures at national level – see Section 5 and Volume 2.

2.1 Fossil fuels.

Since about 1750, fossil fuels have served mankind very well. Without them, the Industrial Revolution and subsequent rapid developments throughout the world would not have been possible. Those fuels, the machines that have been developed to process and use them, and the electricity generated from them, are still staples in every part of modern civilisation. But that familiar position now has to be changed both radically and quickly.

The era of relatively low-cost oil, which has been a crucial factor over the last fifty years in driving the world's economy, is expected to end within the next ten years or so (Campbell, 2003), because global resources of oil are being depleted at such a rapid rate. According to classical economic theory, as the price of oil increases, more expensive sources of energy will be developed.

For example in Canada, the Athabasca Tar Sands in Alberta and Saskatchewan represent a considerable resource of crude oil, and the technology (*"SASOL"*), which was developed to provide transport-fuels by the gasification of coal in South Africa during the embargo imposed by the United Nations on the export of oil to that country before the abolition of *apartheid*, offers another technical solution. But deploying these resources and technologies will substantially increase the cost of fossil fuels, which will have a depressive effect on economies, and increase fuel-poverty.

And the environmental cost of using fossil fuels, including these more expensive substitutes for ordinary crude oil, is unsustainable for other reasons. For example, the Royal Commission on Environmental Pollution (RCEP) concluded in 2000 that, to reach a safe equilibrium of climate, the level of use of fossil fuels has to be reduced by 60 per cent. What is more, this reduction has to be achieved in a relatively short time-span; otherwise, there may well be catastrophes on a global scale.

There is certainly scope for reducing the use of fossil fuels through *"energy-efficiency"*, i.e. using less energy through such means as deploying more efficient equipment and thermal insulation (and even perhaps through reducing levels of luxury), but attention has also to be paid to alternative sources of energy, such as nuclear power and Green Energy.

2.2 Nuclear energy.

A few decades ago, it seemed possible that nuclear energy would provide an attractive alternative, but the nuclear sector has suffered several set-backs. So, today, nuclear power contributes less than 3 per cent of the world's primary energy (about 16 per cent of the global consumption of electricity).

Uranium is also a *"fossil fuel"*, in the sense that it has to be dug from the Earth's crust; and it is available in only limited quantities (Storm van Leeuwen and Philip Smith, 2004). Enthusiasts for nuclear energy hope that the limited life of simple nuclear cycles based on the fission of uranium could be extended by the use of recovered plutonium, and eventually (indefinitely) by nuclear fusion, but there are considerable uncertainties associated with all nuclear technologies.

Today, nuclear power provides about 22 per cent of the UK's electricity (and about 75 per cent of France's), but it makes up much smaller percentages in terms of **total energy**, because nuclear power makes virtually no contribution in the energy used for transport, or for heating of premises.

In the UK today there is (a) an almost open market in electricity, and (b) a tight regulatory system that makes obtaining all consents required for a nuclear station a long and costly business. Thus, it is far from clear that, in these conditions, the existing level of generation of nuclear power in the UK can be sustained, let alone increased. Indeed, the vision of low-cost nuclear power now seems more distant than it was 50 years ago, and a considerable segment of the UK's general public remains very concerned about such issues as (a) pollution from radio-active materials associated with de-commissioning and waste-disposal, and (b) security (in the context of terrorism).

The privatisation of nuclear power in the UK in 1989 revealed for the first time the true costs of nuclear power in this country, which made it impossible to sell that part of the state-owned industry, and that led to the rapid deployment by the UK Government special arrangements, including the *"Non Fossil Fuel Obligation"* (NFFO). At that time, the price that was paid to generators of electricity from fossil fuels was about 3.5 pence/kWh; NFFO forced payments of 6 pence/kWh to nuclear generators, which were kept in the state sector. Later, part of the nuclear estate was privatised as British Energy (BE), but since then that company has had to be rescued by the Government from bankruptcy with substantial injections of extra capital. Despite those rescues, and increases in the value of electricity, BE is still reporting losses and shut-downs of their plants.

In view of the historical connection between nuclear energy and nuclear weapons, the impacts of nuclear accidents (e.g. Chernobyl), the rising level of global terrorist activities and unsolved problems connected with de-commissioning and wastes-disposal, it has been politically impossible for recent UK governments to respond positively to those pressure-groups and independent commentators who urge the resuscitation of the British nuclear industry. Nevertheless, at the European level, considerable effort and expenditure continues to be deployed on nuclear topics. France is about to begin the construction of a new kind of reactor, as parts of its existing stock are ageing and will have to be replaced. China evidently has plans to install 300 GW_e of new nuclear capacity (which is not far short of existing global nuclear capacity of 350 GW_e).

There are reports (e.g. Pincock, 2004) of research to develop *"pebble-bed reactors"*, that are said to be safer and to yield nuclear wastes that are easier to deal with. If nuclear power could indeed be provided safely and at low cost, it would perhaps offer part of a solution for global warming if enough of the world could be served by this energy-source. For example, it is possible to imagine that, in addition to electricity, it could be used to provide hydrogen (which is canvassed as a pollution-free transport-fuel). But the production of hydrogen for use of a transport-fuel will entail losses at an extra process-stage stage (uranium to electricity, and then hydrogen by electrolysis), thus cycle-efficiency will be reduced.

And, to achieve the goal of substitution of fossil fuels with nuclear fuels will require enormous amounts of capital expenditure and a very radical change in public opinion in many countries, including the UK. Furthermore, it is not credible to propose the use of waste heat from nuclear reactors to district heating.

In any case, a massive switch to nuclear power does not sit well with the concept of achieving security of supply of electricity through diversity of technologies. There is no commercial source of prime uranium ore in the UK and, although there are significant resources in Australia, Canada and the USA, more than half of the world's supply is to be found in much more politically unstable regions.

2.3 Green Energy.

There is such a high level of agreement among scientists and others that the threat of global warming is both great and imminent, that it might be thought by some to be an easy thing to define Green Energy simply as energy that can be produced and used without contributing to global warming. But, of course, that is not possible because even those technologies that use no fossil fuels during operation (e.g. wind-power) probably rely on the use of fossil fuels during their manufacturing and construction phases, and also for back-up when they are not operating (e.g. when the wind does not blow). Perhaps it would be possible to devise a *"Green Energy Index"* so as to reward such technologies exactly in relation to their calculated avoided quantum of emissions of Greenhouse gases, but here the best is the enemy of the good. What is needed now is urgent and firm action to take things forward in a robust way, regardless of minor arguments.

The European Directive for support for electricity from renewable sources (D-RES-E), which was published in September, 2001, defines "*renewable energy sources*" as "*renewable non-fossil energy sources (wind, solar, geothermal, wave, tidal, hydro-power, biomass, landfill gas, sewage-treatment-plant gas and biogases)*". And it defines* *"biomass"* as *"the biodegradable fraction of products, wastes and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste"*.

*Note: *there are complexities here concerning (a) the determination of the biodegradable fraction, (b) compliance with the Waste Incineration Directive, and (c) eligibility of Green Power for Renewable Obligation Certificates (see below), but these points are outside the scope of this paper.*

The D-RES-E set *"national indicative targets"* for electricity from renewable sources to be achieved by 2010 – see Table 1. Presumably, if there were a parallel European Directive for **heat** from renewable sources, a similar definition would apply, although there might be some objection to the use of wind, wave, tidal and hydro-power for Green Heat, on the grounds that they would probably have to be used through the medium of electricity, which is not efficient.

Table 1. European national production and targets for the contribution of electricity from renewable sources to gross consumption (sources: EU, 2000 and EC, 2004).

	RES-E (1997) – TWh	**RES-E (1997) – per cent**	**RES-E (2002) – per cent**	**RES-E (target for 2010) – per cent**
Belgium	0.86	1.1	1.4	6.0
Denmark	3.21	8.7	19.6	29.0
Germany	24.91	4.5	8.1	12.5
Greece	3.94	8.6	10.4	20.1
Spain	37.15	19.9	16.2	29.4
France	66.00	15.0	14.4	21.0
Ireland	0.84	3.6	5.1	13.2
Italy	46.46	16.0	16.8	25.0
Luxembourg	0.14	2.1	2.2	5.7
Netherlands	3.45	3.5 (1.8*)	3.3	9.0
Austria	39.05	70.0	68.0	78.1
Portugal	14.30	38.5	19.8	39.0
Finland	19.03	24.7	24.7	31.5
Sweden	72.03	49.1	46.8	60.0
UK	7.04	1.7	2.9	10.0
EU-15	**338.41**	**13.9**	**15.2****	**22**

Notes:

1. **There are differences in data, according to the chosen definitions of eligibility. In some cases, large hydro-power is counted, in others, electricity from non-biodegradable waste.*
2. ***This figure is for 2001.*

It can be seen from Table 1 that the UK has been set a target for Green Electricity that is less than half (in percentage terms) the average target for EU-15.

The D-RES-E requires the European Commission (EC) to assess to what extent the Member States of the EU make progress towards their indicative targets for Green Electricity, and the EC published its first report on this subject in 2004 (see References). From reports on progress by MS, the EC has estimated that the target of 22 per cent in the bottom right-hand corner of Table 1 will be undershot because of an *"imbalance in countries' level of commitment to the development of renewable energy"*. The EC (2004) expects that the achievable level of Green Electricity in 2010 for EU-15, on the basis of existing measures, to be between 18 and 19 per cent of total electricity consumed.

As the EU has introduced measures to support energy-efficiency and the development of Green Electricity and Green Liquid Fuels for Transport; it is therefore somewhat surprising that it has done nothing so far specifically to promote Green Heat, especially because the report (EC, 2004) recognises that, despite its great potential *"the overall development of renewable energy in heating does not give rise to optimism"*.

In the UK, the Renewables Obligation (RO) has replaced NFFO for renewable electricity. The RO obliges licensed suppliers of electricity to secure that Green Electricity provides a rising percentage over time of their total supplies. Generators of Green Electricity, within a system of accreditation operated by the Energy Regulator (OFGEM), are awarded RO Certificates (ROCs) that match their metered output in any given month; ROCs can be traded. If suppliers fail to meet their share of an Obligation, they must pay a fee (the *"buy-out price"*) of 3 pence/kWh into a central fund, which is periodically divided up and repaid to suppliers in the ratio of their percentages of delivery of ROCs to OFGEM. Because there is a shortfall of production of Green Power, this mechanism pushes the value of ROCs well above 3 pence/kWh.

The percentages of Green Electricity required under the RO, and levels of compliance with the RO to date, are shown in Table 2.

Table 2. The RO and levels of compliance.

Years ending 31st March	Obligation as a percentage total supplies	Percentage of total supplies achieved
2003	3.0	1.8
2004	4.3	2.4
2005	4.9	
2006	5.5	
2007	6.7	
2008	7.9	
2009	9.1	
2010	9.7	
2011	10.4	

The UK is in the process of setting itself an extra target of 15.4 per cent by 2015, and a further target of 20 per cent by 2020 has been described as *"aspirational"*.

2.4 What is Green Heat?

According to Friends of the Earth (FoE) and others (2004), the annual amount of renewable heat currently used in the UK is 8,327 GWh/year (equivalent to 716,000 tonnes of oil-equivalent); most of that comes from the burning of wood, with some solar heating*. That this figure is, in reality, very small, can be seen by putting it against the total annual market for all kinds of energy in the UK, which is about 250 million tonnes of oil-equivalent. Roughly a third of that total is used for heating, so perhaps only about 1 per cent of the heating market in the UK is served with Green Heat.

*Note: *see Table 3 in Section 3, below.*

Reference was made above to the issue of defining Green Heat in a robust way. There are several obvious candidates for inclusion, including:

(a) Heat produced from solid biofuels, and from the biodegradable fraction of solid recovered fuels.
(b) Heat from solar and geothermal sources, and/including from heat-pumps.
(c) Waste heat from electricity-stations fuelled with solid biofuel or biogas, and from the biodegradable fraction of solid recovered fuels.

Once the concept of support for Green Heat has been accepted and turned into action, other candidates will also come forward for consideration, for example, the heat developed and used in combined-heat-and-power (CHP) schemes based on fossil fuels. This would be consistent with current suggestions to modify the RO so as to give CHP advantages.

3. WHY THE MARKET FOR GREEN HEAT HAS DEVELOPED VERY SLOWLY IN THE UK.

The EC's first report (2004) on the D-RES-E points out that the average European picture of growth in the production of electricity from biomass is disappointingly slow, and it says that "*co-ordinating policies are lacking and financial support is too little*" and that "*the situation would be very different if biomass heating was as dynamic everywhere as it is in Finland*". Even though that statement takes no account of the wide differences in climate across Europe, there are definitely lessons to be learned from other Member States of the EU.

As already noted, there has been no European measure to support Green Heat, and the EC's report (2004) makes it clear that "*the Commission does not consider appropriate a RES-heat directive* ***in the same format*** [emphasis added] *as the biofuels* [i.e. liquid biofuels for transport] *and electricity directives. Overall targets for renewable-energy sources' share of heating would make no sense because there is no defined group of actors to whom they could be addressed. There is no single "heating-supply industry". Instead, individual consumers usually have to organise the process of turning fuel into heat themselves. Instead, more specific actions linked to specific heating applications are needed. The Community has already adopted Directives on the energy-performance of buildings and co-generation* [= CHP]."

The EC's report, in its specific examination of the situation in the UK, quotes figures for Green Heat, reproduced here in Table 3.

Table 3. Production of Green Heat in the UK - thousands of tonnes of oil-equivalent (TOE)/year {TWh/year}.

Source*	**Year 1997**	**Year 2002**	***"Mid-term potenti***
Biomass heat	917 {10.7}	700 (estimated from 2001) {8.1}	2,000 (grid**) 1,800 (non-grid) {44.1, total}
Solar thermal heat	9 {0.1}	16 {0.2}	4,800 {55.8}
Geothermal heat, including heat-pumps	0.8 {0.001}	0.8 {0.001)	4,800 (55.8)
Totals	927 {10.8)	717 {8.3}	13,400 {155.7}

Notes on Table 3:

1. These terms are those adopted by the EC; in the UK, heat-pumps are/will be associated as much with solar heat as with geothermal heat.*
*2. * **Here "grid" *means heat delivered by district-heating pipes.*

As already noted, the annual consumption of all primary energy in the UK is of the order of 250 million TOE, and heating (as averse from electricity and transport) probably accounts for roughly a third of that figure, so it can be seen from Table 3 that the EC believes that Green Heat has the potential to make a very sizeable future contribution. But it can also be seen that, over the five years from 1997 to 2002, there was a sizeable **fall** in the production of Green Heat in the UK.

There are several fundamental reasons why the development of Green Heat has been much slower in the UK than in several other European countries (especially Finland, Sweden, Denmark and Austria), including:

(a) Differences in climate – the UK has (had) a much more equable climate than some of those other countries, with a smaller range between mean summer and winter temperatures.
(b) The percentage of land covered with forests and other woodland is much lower in the UK than in some of those other countries, which have established forestry-based industries that give rise to large volumes of woody residues that are available as relatively low-cost raw materials for fuels.
(c) The UK has had access to its own sources of fossil fuels that have been made available at relatively low costs, but those other countries have not had that advantage.
(d) Some of those other countries have a tradition of public district-heating services, but these are not well-established in the UK.
(e) Some of those other countries place taxes on fossil fuels for heating.

In the field of Green Energy, most attention in the UK has been paid to Green Electricity, partly because it has been easier for the Government to exert pressure on the key actors in that sector which, until privatisation in 1989/90 was a single, very large, nationalised industry. Despite privatisation, there are still relatively few generators and suppliers of non-renewable electricity, and the rules for their markets have been subject to considerable intervention by the Government and regulators (now OFGEM).

Traditionally in the UK, power stations have been large (500 MW_e and above), and difficult to fit into a near-urban landscape, so their locations are usually distant from potential users of waste heat. The mind-set of the owners and operators of those power-stations has largely been confined to (a) acquiring low-cost fuels - leaving aside nuclear stations, these were formerly mainly coal and oil, but much of their capacity has been replaced with new, much more efficient, gas-powered stations, (b) the physical aspects of producing and exporting that electricity and (c) trading that electricity. Although it would be possible, in principle, to run long pipes to carry hot water to central London from, say, the large coal-fired power stations to the east of London (e.g. those at Kingsnorth and Tilbury), such pipes would be extremely expensive to install. Furthermore, London is already heated almost entirely by an existing infrastructure based on gas that is piped through a comprehensive network of pipes. And, until now, gas has been relatively cheap.

During the 1980s and 1990s, great technical advances were made in parts of the electricity industry. For example, before 1989, it was not legal to use gas for power-generation, but the changes associated with privatisation allowed access to both another cheap source of fuel (at least in the short term) and, more importantly, to a much more efficient energy-conversion technology – the *"combined cycle"*. Engineers use the word *"cycle"* to mean a type of process for energy-conversion, and the word *"combined"* here means that the gas is first burned in a gas-turbine, and then heat is recovered from the exhaust gases and converted into steam, and then that steam is used to drive another turbine. Levels of conversion-efficiency approaching 60 per cent can be obtained by this means, compared with those in the mid to upper 30s for the traditional coal-fired stations.

Applied across a large slice of the UK's production of electricity, an improvement in efficiency of only 1 or 2 per cent can save large amounts of fuel, so that improvement of the order of 20 per cent in conversion-efficiency has been a great achievement, and that has obviously been in the forefront of the minds of the experts who have advised the European Commission and the UK Government to take a similar approach to the deployment of Green Energy fuelled with biomass. Unfortunately, having focused on high-efficiency cycles to produce electricity from wood, they seem to have given Green Heat an unjustifiably low priority so far.

For example, in the second half of the 1990s, large amounts of public and private money were invested in at least four projects in Europe to build combined-cycle plants that included gasifiers to convert wood into a gas of a quality that could be burned in a gas-turbine to generate electricity. Only one of those projects (located at Värnamo in Sweden) reached the stage of being commissioned and run for some months of trials; it was then mothballed. The other three (in Denmark, Italy and the ARBRE Project in the UK) all failed before being commissioned. Much less money and effort has been put into the promotion of Green Heat.

In the third round of NFFO in 1995, three contracts were awarded for projects proposed to gasify wood (including the ARBRE Project), but none of them has been built. So, apart from Slough Heat and Power's plant, which is now fuelled with wood, and a few small projects, the only electricity plants in the UK that are using solid biofuels alone (i.e. excluding co-firing with coal and the use of mixed wastes) are being fuelled with poultry-litter or straw. And rather little Green Heat is being sold from most of these plants because, in business terms, it is usually not profitable to install the necessary infrastructure.

The UK Government has recently held a competition to select several Green Electricity projects for capital grants, including five in the south west of England that are based on the use of solid biofuels; there are also various capital grants applicable for Green Heat. But these measures have not been sufficient to give a real impetus to the use of biofuels, and several bodies have called for stronger and clearer action by the UK Government. Capital grants attract a good deal of attention but, as is pointed out by RCEP (2004), *"The main problem is that the government's capital-grants schemes for biomass initiatives have focussed on high-technology approaches to electricity-only generation … demonstration schemes have not been based on established technology and they have consequently failed, with resulting loss of confidence … The complexity of grant schemes has made it difficult to make headway … we identified 14 different grant schemes, but found no national … co-ordination …"*

RCEP (2004) also states: *"Whereas green power* [= electricity] *can attract a price of 6.5 to 7 pence/kWh in total, green heat can attract an income of only 1 to 1.5 pence/kWh. This encourages the development of the less efficient green electricity market at the expense of the more efficient green heat market …"*.

There seems to be growing awareness of the problems, but there are a number of obstacles to progress that are being put in place, even by some of those that are keen to promote Green Energy. For example, because of difficulties in obtaining planning-consents for some Green Electricity (mainly wind-power) projects, the notion has arisen that planning authorities should be encouraged/compelled to grant a certain number of consents to such projects. What has emerged from that debate is *"planning targets"*. But those targets are usually restricted to Green Electricity, whereas they ought also to include Green Heat, and they may be expressed in terms of capacity for generation (i.e. MW), rather than output (MWh). This practice unduly favours wind-power, which as already noted, shows poor levels of availability, and is not a sensible basis for providing heat, except in unusual circumstances.

Despite a long period of not giving much consideration to Green Heat, the Government seems now to have taken up the issue. For example, the Department of Trade and Industry (DTI) has recently announced that it will consider support for Green Heat in parallel with the review of the RO that it will make in 2005/6.

In October, 2004, the Department of the Environment, Food and Rural Affairs (DEFRA) set up a new Biomass Study Task Force *"to help the Government and the industry develop biomass energy in support of renewable-energy targets and sustainable farming and forestry objectives"*. According to the terms of reference for the Task Force, it will *"Identify possible measures to support the development of biomass energy; analyse the economic costs and benefits of each recommendation; and work with* [others] *to identify barriers in the supply chain and ways of overcoming them"; etc.* Unfortunately, *"the barriers in question are* [limited to] *the current frailty of the supply-chain, technical factors, planning restrictions and environmental factors relating to land-use"* – yet some other issues are probably of greater significance.

For example, these words seem to exclude an examination of the need for new financial instruments to develop a static market, and indeed the Notes on the terms of reference end with: *"The Study should not make recommendations on tax issues"*. Perhaps those tax-issues, which are extremely important (see Section 6) could be taken up by another Department of State?

4. WHY, AMONG CHOICES WITHIN RENEWABLE ENERGY, GREEN HEAT OFFERS THE BEST VALUE FOR FINANCIAL SUPPORT.

The rapid development in the UK of energy-saving measures and Green Heat, offers advantages in several areas, including security of supply - as home-based reserves of oil and gas become exhausted, the country will rely increasingly on imports. There is a significant opportunity to establish supplies of wood-fuels from existing woodlands, and these could be extended. If that industry is built up carefully, its social and environmental effects could also be strongly positive.

RCEP (2004) has pointed out that *"Biomass energy technology is inherently flexible …* [it] *can be tailored to rural or urban environments, and utilised in domestic, commercial or industrial applications"*, so why has the technology made so little headway in the UK?

The following factors should be considered when comparing various sources of renewable energy to establish the best-value options:

(a) Potential demand.
(b) The overall financial model (especially preliminary, capital and running costs, and likely revenues).
(c) External (social and environmental costs).
(d) Ease of integration into the national infrastructure (e.g. planning issues, such as visual impact, noise, traffic, waste-generation, etc.).

That there is no shortage of demand for space-heating and residential hot water is shown in Table 4.

Table 4. Specific consumptions of heat generated from fossil fuels, and electricity for various types of consumer.

Specific use	**Fossil fuel used for space-heating and for residential hot water- kWh_{th}/year**	**Electricity used – kW_e/year**
Hospitals (per bed)	25,740	7,000
Universities (per student)	4,200	1,710
Factories (per m^2 of floor)	245	47 (see Note 2)
Local government offices (per m^2 of floor)	95	39
Commercial offices (per m^2 of floor)	147	95
Retail premises (per m^2 of floor)	185	275
Warehouses (per m^2 of floor)	64	81
Hotels (per bedroom)	13,620	6,387
Schools (per pupil)	2,583	372

Notes.

1. This data was taken from the report on biomass by RCEP (2004).
2. The figure for electricity used by factories does not include that used in production processes, etc.
3. The percentage of efficiency for generation of electricity from fossil fuels has to be taken into account (see text).

The *per capita* use of primary energy in the UK's residential sector is broadly similar to that of France, Germany and The Netherlands at around 750 kg of oil-equivalent/person/year (Earthtrends, 2004). In total, the UK residential sector consumes about 35 million TOE/year of gas, mostly for heating. The low costs of gas (and, to a lesser extent, oil) used for heating, and of the equipment (boilers, etc.) to burn those fossil fuels, coupled with the unfamiliarity in the UK of solid biofuels, heat-pumps, solar heating, etc., are all holding back development of the market for Green Heat. Furthermore, the pricing (including taxation) of fossil fuels takes no account of the external (social and environmental) costs.

Quoting from RCEP (2004) again: *"Unlike most other renewable energy sources biomass can be stored and used on demand to give controllable energy. It is therefore free from the problem of intermittency, which is a problem for wind-power in particular. Also, unlike most other renewable sources, biomass offers potential as a source of heat as well as electricity, offering high conversion efficiencies.* ***This potential appears to have been overlooked in government policies to promote biomass, which have concentrated on electricity generation.***" [emphasis added].

What is more, since about 1990, despite the Government's programme to spread financial support to the Green-Electricity sector across all of the more promising technologies, only landfill-gas (LFG) generation and on-shore wind-power have prospered. Today, together they make up 60 to 70 per cent of the UK's output of Green Electricity as defined by the RO. The success of LFG and land-based wind-power is easily explained by their low unit-costs, some of which have been diminished greatly since 1990, partly as result of lessons learned through repeated replication, and partly through the scope for scale-factor reductions as the markets have grown. But neither of these technologies has supplied much Green Heat. This position is immediately obvious for wind-power, but perhaps not for LFG. Some landfills are sited close to one or more customers for heat arising from combusting the gas directly, or from the engines used to generate power, but it has proved to be extremely difficult to exploit the considerable amounts of Green Heat that are currently going to waste, partly because of (a) the high capital cost of installing the pipework relative to the value of the heat, and (b) the inertia of customers because of their currently low costs associated with using fossil fuels.

This report has been written as one of the preparations for a campaign to persuade the Government that Green Heat (from biomass, solar and heat-pumps) can indeed offer better value than some other forms of Green Energy in increasing UK-supplies of useful energy and also in combating climate-change. In that context, some simple examples may help to focus attention on the best ways **quickly** to achieve overall improvements in efficiency and, at the same time, to maximise reductions in emissions of Greenhouse gases.

Obviously CHP offers in theory very high rates of overall efficiency, but most existing thermal power stations are sited far from centres of population. The costs of adapting those power stations to CHP would be extremely high.

A great deal of discussion is in progress about promoting new CHP projects based on natural gas. One of the problems facing developers of such projects is that the prices of gas and electricity vary separately to some extent, so there is a level of commercial risk that many find to be unacceptable. A Member of Parliament, Dr Alan Whitehead, has suggested that the Government should introduce a measure to reduce that risk (the "*Whitehead Spark Spread"*).

But it can be argued that the best way to proceed will be to continue to burn natural gas in combined-cycle power stations to make electricity at percentage levels of efficiency in the upper 50s, and to burn wood for heating in new boilers at percentage efficiencies of up to the 90s. Simple arithmetic suggests that this will produce a better result rather than continuing to heat with gas or oil (with percentage efficiencies also in the 90s) and to generate electricity with wood in new power stations, or co-firing in existing coal-burners, at percentage efficiencies from the low 20s to mid-to-upper 30s, unless there is a real opportunity for the waste heat to be recovered and used for heating.

5. THE POSITION IN OTHER EUROPEAN COUNTRIES.

As a part of this study, an investigation is being made of the relevant laws, policies and practices that are in force in some other European countries. The results to date of that work are contained in Volume 2 of this report. XXX INSERT A SUMMARY OF MAIN FINDINGS HERE

6. OPTIONS FOR CHANGE AND RECOMMENDATIONS.

One of the main reasons for considering this subject now is that, as already noted, DTI has announced that it will consider support for Green Heat in parallel with the review of the RO that it will make in 2005/6. As in the case of Green Electricity several years ago, when it had become clear that NFFO was not meeting expectations, and thoughts were turning to a better option (which turned out to be the RO), there is an urgent need for a very thorough examination of all aspects of Green Heat, and for developing a broad consensus on the best means of delivering worthy progress.

6.1 A Green Heat Obligation?

The report by RCEP (2004) concluded that *"the most obvious gap in current support schemes is the lack of any mechanism for supporting the generation of renewable heat energy, **comparable for example to the RO scheme for renewable electricity**"* [emphasis added] and recommended that the Government should introduce such a mechanism, which *"could be set up along the lines of the RO, and oblige current heat suppliers (gas, oil and electricity) to supply a given percentage of their heat from renewable sources by a set date …"*.

But it will be recalled that, at the beginning of Section 3, it was noted that the EC *"does not consider it appropriate to bring forward a RES-heat directive **in the same format** as the biofuels* [i.e. liquid biofuels for transport] *and electricity directives.* [emphasis added] *Overall targets for renewable-energy sources' share of heating would make no sense because there is no defined group of actors to whom they could be addressed. There is no single heating-supply industry"*.

Nevertheless a group of organisations in the UK (Friends of the Earth, 2004) picked up the recommendation of the RCEP and suggested that (a) a (renewable) Heat Obligation (HO) be placed on the suppliers of fossil fuels used for heating – gas, coal, coke and oil, and (b) that suppliers of renewable heat be certified by OFGEM, and have their outputs measured, so that they will receive Heat Obligation Certificates (HOCs) that they can sell.

The group of organisations that supported this idea included FoE, British Biogen, the Combined Heat and Power Association, the National Farmers Union, the Renewable Power Association, the Socialist Environment and Resources Association, Slough Heat and Power Ltd, the Country Land and Business Association, and the Solar Trade Association.
In a recently-published book, Drs Catherine Mitchell and Bridget Woodman (2004) also supported the introduction of a *"renewable heat obligation"*.

A lobby to encourage the enactment of a HO then gathered pace. For example, an unsuccessful attempt was made to include it in what became the Energy Act, 2004 and, on the 25th October, 2004, Lord Redesdale moved the first reading of his private member's Renewable Energy Bill. This proposed an unquantified obligation on *"public energy suppliers"* (suppliers of gas and heating-oil) to have available supplies of energy from *"non-fossil fuel sources"*. And on the 12th January, 2005, Mr Michael Weir, MP for Angus, moved the first reading of his Renewable Heat Bill; it was reported that he was supported by a consortium including FoE. The second reading was due on the 4th February, 2005, but the Government raised an objection and the Bill was not debated.

The authors of this report support the motives of all of these persons and bodies in seeking support for Green Heat, but have reservations about the usefulness of a HO in that context, where four main groups of issues are relevant:

1. ***The objectives.*** Although there are many reasons to encourage the production and use of Green Heat, the higher-level objectives are (a) to establish more sustainable and secure patterns of supply and use of energy in the UK, (b) to counter climate-change by reducing emissions of Greenhouse gases associated with the nation's use of fossil fuels, and (c) to achieve these things by the most effective means available. Green Heat is a good way to meet these objectives, but support for it must be pursued in ways that pay careful attention to (i) coherence with other measures, such as energy-saving, (ii) minimising the costs of implementation and enforcement, (iii) minimising the risks of fraud, and (iv) ensuring an appropriate spread of benefits among various parties

2. ***Complexity.*** The RO shows that an obligation can work where there are a limited number of producers and suppliers of energy, so that the complex process of authenticating, trading and redeeming certificates can be handled by a limited number of experts. But large producers/suppliers of heat represent only a small part of the market in the UK - there are literally millions of producers of heat, most of whom are individual households or small companies. It is certainly technically possible to install heat-meters in large and small premises that have installed wood-burning boilers, etc., but any system that requires a huge number of parties to register with OFGEM, obtain accreditation and then to obtain and trade HOCs seems doomed to failure. A much simpler approach should therefore be sought.

A further problem arises as it is only the Green Heat that can be used beneficially that should be considered, not the totality that is produced. In that context, it should be noted that it could be difficult to meter the net heat-gain from a heat-pump, and that passive solar-heating systems produce heat even when it is not needed.

3. ***The legal angles.*** Any system that entails making payments of money requires to be made robust against misinterpretation and misuse, and that robustness must be secured at a low cost. In view of remarks already made above, it seems that it will be difficult to achieve that aim. Furthermore, **any** form of support for Green Heat to be enacted by the UK Government will have to be accepted by the EC under the State-Aid Rules, as was the RO. Although the EC does not favour a solution that follows the **format** of the RO, perhaps that leaves open the possibility of promoting Green Heat using a **different** format that can be accepted by the UK Government and then endorsed by the EC.

4. ***Coherence with other public policies on energy***. The HO in the model being suggested by FoE *et al.* does not necessarily offer a reward for energy-efficiency, because it proposes that the **production** of Green Heat should be rewarded, without regard to the scale of reduction of use of fossil fuels. Theoretically under that system, it would be possible to produce Green Heat, meter it to gain the Certificate, and then throw the heat away. This illustrates a weakness in the concept of a HO that springs from not linking Green Heat directly to energy-efficiency. Any system to support Green Heat ought to work in such a way as to promote the maximum reduction in the use of fossil fuels.

Preliminary discussions with some supporters of the proposed HO have disclosed that they believe that, if a simple tax were introduced on fossil fuels for heating, with its revenues returning to the Treasury, middle- and upper-income consumers would just pay such a tax without changing their behaviour, and that fuel-poor people (those who spend more than 10 per cent of the income on energy) would become even poorer. They point to the RO as a successful model for a HO, but there are striking differences between the two markets for electricity and heat. Part of the reason that it was feasible to impose the RO on suppliers of electricity was because they sell power into an almost complete national grid, with extensive local distribution networks from which customers draw their individual supplies of electricity, but the analogy does not hold for heat.

Indeed, the companies that sell oil and gas for heating do not sell heat at all - they sell fuels. Even if they moved into the area of supplying biofuels (and perhaps also equipment for burning them) and/or heat-pumps, etc., they then could not be sure that they would have a large enough market because the choice of energy-conversion unit lies with the customers. And an Obligation to buy HOCs could not really operate immediately if, as is currently the case, there is very little Green Heat that can be certificated.

Some supporters of a HO see it as a way to kick-start projects for the generation of CHP from biomass in the UK, which has had a very slow take-off, because it would put the promise of extra money directly into the hands of developers of such projects. An approach, based on amendments to taxation (see below) would also work in the same direction, of course. It would also encourage the most effective ways of reducing emissions of carbon dioxide from fossil fuels, **including energy-efficiency**, and without picking winners among technologies.

6.2 Some practical considerations in the implementation of a Heat Obligation.

When contemplating the practicalities of the implementation of the HO that has been proposed by FoE and others, it is helpful to consider a hypothetical *scenario* in which OFGEM will be required to validate HOCs (one HOC representing 1MWth of eligible heat). That *scenario* should be set in the context of the residential market for heating fuels, because that sector consumes roughly four times as much fossil fuel as the industrial and commercial sectors. What is more, a significant part of the industrial consumption is in specialised applications that require the use of fossil-fuels, which is not specifically required for heating houses. So, in the example to be examined, *"eligible heat"* will include heat from systems relying on the combustion of biomass, heat-pumps, passive solar-heating and possibly CHP.

In 2003, UK residential consumption of natural gas was 386 TWh, i.e. about 21 per cent of the total energy consumed by final users* in the UK (DTI, 2004). Assuming that (a) there are around 20 million households in the UK, (b) a small proportion of residential gas is used for purposes other than heating (such as cooking), but (c) relatively small quantities of other fossil fuels are used for heating, it can reasonably be assumed that average annual consumption per household of fossil fuels for heating is equivalent to about 19 MWh.

*Note: *the total annual consumption of **primary** energy is 250 million TOE, but the amount consumed by final users is only about 160 million TOE (the difference is accounted for by, for example, the conversion of primary fuels into electricity.*

If the HO were introduced, the legislator and/or the regulator would face a multitude of questions about eligibility, including the following examples:

(a) Will the user of biofuels for heating be required to prove the use of a system having at least a certain level of conversion-efficiency?
(b) How will the acceptability and output of a passive-solar system be defined and quantified? Will it be necessary to have radiators on the roof, pumps in the attic and meters by the hot-water tank for solar energy to qualify? Will houses designed to maximise solar gain on cold days and minimise solar gain on warm days be excluded, or will some method be devised to calculate their HOC entitlement?
(c) Will the scheme include heat from both ground- and air-source heat-pumps? If so, will the (mostly non-Green) electricity needed to power the heat-pump be deducted from the calculation of the coefficient of performance?
(d) Will electrical heating using power from renewable sources be eligible? How would this be validated? Would the scheme apply only to on-site renewable generation?
(e) Will the combustion of waste products be eligible? Will those waste products have to be separated, or gasified, pyrolised or digested to count as eligible fuels?
(f) Will CHP be eligible for HOCs? If so, will the eligibility be restricted to those projects that use no fossil fuels? If CHP based on fossil fuels (e.g. natural gas) is also eligible, will some sort of banding be necessary to take account of the fossil-fuel combustion (e.g. would heat from CHP receive 1 HOC per 2MWth)?
(g) Will heat from CHP from Sterling engines fuelled with natural gas, which produce about 90 per cent of heat and 10 per cent of electricity, receive the same number of HOCs per MWth as heat from a small reciprocating engine that produces about 60 per cent of heat and 40 per cent of electricity?

Then, even if a satisfactory definition of eligibility of the heat-sources can be settled, other questions will also have to be faced. In the model proposed by FoE and others, the HO will be placed on suppliers of "*fossil-fuel heating fuels*", who will have to (a) generate heat (and thus HOCs) themselves – an unfamiliar new business for them, or (b) buy HOCs from other eligible heat producers, or (c) buy out the unfulfilled proportion of their part of the HO at a price to be set by Government (to act as a cap on the cost of the scheme). If, for the sake of simplicity, complications such as banded values for HOCs are ignored, at least the following questions arise:

(h) Who falls within the definition "*supplier of fossil-fuel heating fuels*"?
(i) What should be the levels of the obligation (assuming the obligation will be designed, like the RO, to increment)?
(j) What should be the level of the buy-out?
(k) What mechanism should be used to calculate an individual supplier's obligation relative to the general level?

Each of these questions raises several issues, but for purposes of a general examination, let it be assumed that reasonably simple compromises will be reached, as follows:

1. All suppliers of natural gas, coal (and coal products), heating oil, propane and other fossil-fuel derivatives will be defined as "*suppliers of fossil-fuel heating fuels*".
2. An escalating HO will be implemented, with arrangements similar to those of the RO, say 3 per cent in Year 1, rising by 1 percentage point per year to 15 in Year 13.
3. The buy-out for the RO was set at a level roughly equivalent to two-thirds of the cost (at the time) of electricity to the consumer, which was judged to be an appropriate level to ensure that the cost of the policy to the consumer would not be politically unacceptable. Perhaps, for the same reasons, the buy-out for the HO could be set at a price roughly equivalent to two-thirds of the cost of natural gas to the consumer, say (in round numbers) 1 penny/kWh (£10/MWh), as suggested by FoE and others.
4. Each supplier's share of the HO (and level of compliance) will be calculated annually based on sales of all eligible fossil-fuels in that year. For those fuels not sold by the kWh, they will be converted to equivalent values of kWh using specified calorific values for the fuel.

Assuming that these rules were put in place, how could fuel-supplying companies go about fulfilling their obligations? At present, such companies do not produce heat, so they are unable simply to install HO-eligible heat-generation equipment to produce theirs own HOCs. Nor are there many heat-producers with whom the supplier can contract for HOCs. Instead, the fuel-suppliers must persuade their customers to (a) install such equipment and (b) sell the HOCs produced to the fuel-suppliers. This will not be an easy task, as can be readily seen, as follows.

Unless a customer's heating equipment happens to be on its last legs, that customer is unlikely to want to supplement a functioning system with a new piece of technology (a wood-burning boiler, passive-solar tubes etc.) unless there is some real financial (or other) incentive. Resistance from customers might well show itself as one or more of the following questions or points:

(a) "Who is going to pay for the purchase and installation of this equipment, including integrating it with the existing heating system?
(b) I have been used to using gas as I need it; are you suggesting that now I'll have to find a suitable fuel-supplier (in the case of biomass-burners), and spend time managing a stock of fuel (in particular, re-ordering when stocks are low).
(c) *Aren't I going to need to continue with a gas-supply for my cooker, or are you asking me to replace that as well*?"
(d) From what you tell me, I shall be paying significantly more for fuel (for example, in the case of wood-pellets) than I have been for gas. Also, you are suggesting that I should manage a process of registration, metering, certification and sale of HOCs.
(e) But why should I throw away a working boiler to buy something that is larger and less easy to use (extra space has to be found for storage of biofuel)?
(f) Aren't I going to need back-up for a technology such as a passive-solar system that cannot deliver 100-per-cent availability?"

So the fuel-suppliers would have to be armed with persuasive answers on all these points, and also be conversant with all of the relevant technical data. For example, the flue for any biomass-burning boiler should be designed and installed in such a way as to conform to Building Regulations (e.g. there should be a clearance of 2 m from walls or roofs if it is below a roof-line, or if above, must project by a minimum allowable distance). If any equipment results in a visible change to a roof-line, planning-permission may also have to be obtained.

Considering this kind of complexity, it becomes clearer than ever that the package would be very difficult to sell to residential customers, unless the fuel-suppliers would take on the responsibility, and the extra cost of implementing it, otherwise most customers would not agree to participate. Theoretically, fuel-suppliers could offer to pay for (a) the cost of purchasing and installing the equipment, (b) managing the registration, meter-reading and certification of the HOCs, (c) any local regulatory costs, and possibly (d) managing the fuel-supply. If the suppliers have to handle all such costs, they will want long-term contracts with customers, binding them to buy the green fuels (or their equivalent) and to sell the HOCs to the suppliers. Then the questions arise: how many customers will such sign contracts, and what are the implications of the fact that many people move house more frequently than once in ten years?

All of these issues will have to be resolved satisfactorily; otherwise, the fuel-suppliers will be forced to opt to pay the buy-out price. If that happens, insofar as the residential market is concerned, then the HO will become a tax.

6.3 *"Hands-on" v. "Hands-off"* measures.

There seems to be growing support for the notion that something must be done to drive forward the development of Green Heat in the UK, but not necessarily yet about how that should be achieved. The authors of this paper are firmly in favour of measures that will minimise further regulation and bureaucracy. The general public ought to be given (a) clear information about the great challenges that face mankind in the energy field, and then (b) clear choices on whether and how to spend their money on energy. After that, the market should be allowed to operate.

Since 1990, successive Governments have tried a range of *"hands-on"* measures to promote Green Energy, such as the Non-Fossil Fuel Obligation, and capital grants. In the field of energy from biomass, these have not worked well, and the reasons for this can arguably be traced to the difficulties associated with using public-sector minds and money to pick industrial winners. Indeed, in setting up the RO, the Government said that it had set its face against picking winners, which gave developers of Green Electricity projects some confidence in a new market. But when, within about a year, the Government announced a review of the RO, there was an immediate fall in confidence among developers and their other investors; luckily, the Government quickly recognised that and gave assurances that they wanted to a stable market.

Customers are unlikely to change from their current level of use of fossil fuels for heating unless they see a distinct financial advantage in so doing, without incurring unacceptable inconvenience. As things stand, the equipment required for Green Heat is often more expensive than that used for burning fossil fuels, which is why the Government has established some capital grants for such equipment.

Although some forms of Green Heat (e.g. passive solar heating) require no fuels, others do, and no grants are available for purchasing biofuels. Capital grants can be had for establishing certain kinds of energy crops, but this too has not been enough to kick-start a new market.

For these reasons, financial measures should be implemented so as to increase the costs of fossil fuels to such a level as to make expenditure on biofuels (or on other forms of Green Heat, or on energy-saving) attractive to potential customers.

Business generally is greatly concerned about the ever-growing cost of regulation, and this paper has been written with the intention of seeking financial measures that will have a strongly positive promotional effect on Green Heat, but at a low regulatory cost.

RCEP (2004) mentions one such possibility – *"an approach based on the taxation of CO_2 emissions would promote all renewable energy sources, would require fewer specific measures and would automatically promote heat as well as electrical output. The introduction of the EU-wide emission trading system will favour biomass along with other renewable energy sources, but whether the price will be high enough to provide a serious incentive remains uncertain at this stage"*.

It is understood that the regulator OFGEM also favours broadly-based market-mechanisms such as emissions trading. In practice, however, the first version of the European Emissions Trading Scheme that is nearing completion will entirely exempt residential and other small-scale producers and users of heat.

In a recently published report on the potential for wood-fuelled heating and CHP projects in south-west England (Bullard, Rebecca Heaton and Osola, 2004) recommend that development of the market be founded on the following principles:

(a) concentrating on heating rather than on CHP;
(b) focusing on areas that are distant from the national grid of gas-supply;
(c) targeting buildings larger than single residential properties (the larger the better); and
(d) securing capital grants from the Government for the combustion-equipment.

The audience for that report was a public-sector body, Regen SW, the regional renewable-energy agency for south-west England. Such bodies are playing a role in facilitating new projects where private-sector investment is difficult to secure because of, for example, excessive levels of risk. They can do so presumably because they have better access than does the private sector to national and European grants (such as Landfill Tax Credits and the Objective-1 Fund).

Bullard *et al.*, however, recognise that some participation by the private sector will be essential and recommend a particular form for it: *"Our analysis is that, for wood-heating to achieve a significant level of penetration …a hybrid between an energy co-operative and an energy-supply company (ESCO) be established which embodies the best traits of both. Namely, the commercial acumen of the ESCO, with the strategic initiative development of the energy agency. It will be essential to include stakeholders from local authorities (LA) in which the hybrid body will be active. In reality, this LA support will need to include financial support … to spread the financial risk of the venture"*.

Arrangements of this kind obviously raise issues of governance and fair competition, but these are outside the scope of this report. Another aspect is, however, germane to the main topic considered herein because Bullard *et al.* are suggesting that public money (i.e. money drawn from general taxation) effectively be put at the disposal of such hybrid bodies, and yet are recommending that attention should not be focused on the dwellings of the taxpayers. This recommendation has some features that may be palatable to some politicians, for example it might not raise an outcry about *"stealth taxes"*; but it will not lead to the scale of change of public behaviour that must be sought if the big issues of climate-change and depletion of lower-cost energy-resources are to be addressed effectively.

Researchers at the Tyndall Centre for Climate Change Research (Anderson and Starkey, 2004) have suggested a completely different approach that they call *"domestic tradable quotas*" (DTQ) or *"carbon rationing"*. And in 2004, Mr Colin Challen MP introduced a Private Member's Bill – the DTQ (Carbon Emissions) Bill – but it did not proceed to a Second Reading.

The concept underlying DTQs is that the Government would set an annual carbon budget, tied to the maximum amount of emissions that can be permitted if commitments are to be met, and the budget would be reduced year-on-year until the target of a 60-per-cent reduction in emissions by 2050 is met. Individual consumers would be issued with credit cards and, when carbon-fuels are bought, some of the credit would be debited; trading in the credits would be permitted.

A key feature of this proposal is a concern for social equity within an international framework, so that *"Each carbon budget is divided into carbon units … a proportion of these units is allocated by government, free and on equal* per-capita *basis, to all adult citizens … The remaining carbon units are allocated to firms and other organisations through a government-regulated auction"*.

Anderson and Starkey state that *"The fuel-protests of 2000 illustrated the public antipathy that can arise in response to even small rises in carbon taxation; such antipathy would likely escalate if substantially higher levels of taxation were introduced … DTQs may provide an opportunity to mitigate such antipathy through the explicit inclusion of citizens …Rather than confronting citizens with higher prices,* [this proposal] *enlists them as environmental stakeholders … It is probable that the public will perceive this equal allocation to be broadly fair …"*.

One strength of this proposal is that it takes a holistic and impartial view of energy-usage. Some other proposals attempt to support one or other solution without allowing for fair and equal comparison between the options of, for example, (a) reduction of energy-consumption and (b) switching to Green Energy. In the worst case, giving incentives to consumers to switch to Green Energy, rather than giving disincentives to continue to consume Brown Energy, will result in a continuation of the unsustainable depletion of resources, and of the exacerbation of global warming.

However, the proposal for DTQs shows many weaknesses, for example:

(a) The system implies an **absolute** cap on emissions; otherwise it will not deliver the required result. But what would happen when individuals and organisations reach the tenth or eleventh month of a year and (for whatever reason) some of them find that they have used up all of their DTQs, and there are none available from any other source? Will the Government then have a sufficiently strong political will to be able to tell such people that they will have to live for one or two months without fossil fuels? Or will there be support for the basic concept to be altered to cope with this perceived difficulty? For example, some carbon-units could be held in reserve to be bought at a higher price. It is clear that a straightforward energy-tax, with extra features such as rebates to deal with fuel-poverty, would be a much simpler way to proceed.

(b) Would carbon-units have a monetary face-value when they are issued (obviously they will have a monetary value when they are traded)? It is hard to see how the system can be enforced unless they bear such a face-value; but, on the other hand, it is equally hard to see how, if carbon-units become effectively the currency (displacing monetary payments), energy-middlemen (retailers and traders) would be able to make a profit – a cut for them would distort the operation of the system. And if they cannot make a profit, there would be no incentive for them to engage in the business. So the most practical choice seems to be to give carbon-units a value that contributes to the monetary costs of buying energy. This will require funding by the Government (= the taxpayers). But, if taxpayers are going to face a new tax related to reducing the use of fossil fuels, why not make that tax as the direct disincentive to consumption, rather than employing the complex mechanism of DTQs?

(c) If DTQs are to be issued on a *per-capita* basis, information will need to be held for all eligible individuals in the country. The proposal suggests a database holding a *"carbon-unit account"* for each citizen, who would each use a *"carbon-card"* on which carbon-transactions would be recorded. Such a centralised database holding information about all citizens will be seen by a significant proportion of the population as having the same worrying features as identity (ID) cards. Although some nations are used to this approach, it is not well established in the UK.

(d) Although it is inevitable that all citizens must think more carefully about their use of energy, the proposal for DTQs implies a high level of participation in energy-trading by all individuals. It is certainly reasonable to expect people to review their installations and practices to try to reduce their consumption of energy, and to reap the benefits of such changes as they then make – that process can be incentivised with a tax to drive up the cost of energy. But is it reasonable to expect all people constantly to track both their own balances of DTQs and the markets for them, and then to make small trades in carbon-credits or -deficits?

(e) Anderson and Starkey propose that all individuals who have a low income be compensated so that they are not disadvantaged by the system of DTQs. It is important to note, however, that many households having low incomes are in houses that have relatively poor levels of insulation. Compensation of this kind, therefore, does not address the key issue of improving those properties. The option of improving the thermal insulation of the properties while leaving the cost of energy at a very low level will also not necessarily produce the required result, as it will not deal with the household that runs its heating system with the windows wide open. The better way of addressing the issue of low-income households and fuel-poverty is to apply incentives equally to everyone to save energy, but also to provide financial and conceptual help to those who otherwise would not be able to identify and/or implement the measures that are necessary to reduce their fuel-bills.

(f) These authors have also entered into the very difficult area of the extent to which children should be treated as individuals to be allocated DTQs. If the *per-capita* allocation includes an allowance for children, individuals without children will arguably be disadvantaged; and *vice versa.* The suggested compromise solution of allocating DTQs to individuals but also compensating families (presumably from taxation) again raises the point that this requires money to be collected from somewhere to pay for that compensation.

More such points can be made, but it is useful to understand that the prime aim of the proposers of this system is that it shall be *"fair"*, which they see as a vital pre-condition for a broad acceptance by the voting public. But history shows that it is impossible to satisfy fully everyone's needs and aspirations, and factions will use special pleading to promote **their** particular view of *"fairness"*. All that politicians can hope to do is to introduce measures that are judged by a majority of people to be fair. For example, most voters (although few of them like paying taxes) probably regard vehicle-fuel duty as broadly fair but, some years ago, passions ran so high among farmers and hauliers that a state of civil unrest was narrowly avoided. It is obvious that DTQs would not have solved that confrontation.

Nevertheless, DTQs (like a recycled carbon-tax) does have the advantage over the proposed HO because it would incentivise the general reduction of the use of fossil fuels.

Other authors are suggesting even more radical ideas; for example, the Irish Foundation for the Economics of Sustainability (FEASTA) are proposing (2005) that *"oil-buying countries … establish an oil-buyers' cartel which would negotiate with the producers' cartel … OPEC. Together they would agree a price for whatever amount of oil could be produced each year and the buyers' cartel would then allocate that oil among its members … the buyers' cartel would not be able to confine its activities to oil … it would have to take in …gas and coal as well"*. The system of sharing envisaged by FEASTA is a global version of DTQs, and is based on a vision advanced by the Global Commons Institute of London.

These exercises in seeking solutions to expected problems are worthwhile to the extent that they cause people to think about those problems, but there must be strong doubts about the extent to which they can contribute to immediate action to address climate-change and the depletion of fossil fuels.

Whatever measures are introduced (and it should be clear to policy-makers clear that firm action cannot be delayed indefinitely), those that are selected must:

(a) secure real progress towards the growth of Green Heat in the UK;
(b) be seen to be fair and reasonable;
(c) be simple and secure and have a low cost of administration;
(d) not increase the general burden on taxpayers at large; and
(e) take account of the sectors of society that needs special consideration.

Despite the view expressed by Anderson and Starkey about the general public's inherent resistance to increased taxation, there are existing taxes on fossil fuels, and these should be re-examined. A good starting point is the Climate Change Levy.

6.4 The Climate Change Levy.

6.4.1 The history of the Climate Change Levy.

During the late 1990s, there was considerable public support for the introduction of measures to combat climate-change, and there were extensive debates about the *pros* and *cons* of a Carbon Tax to help governments to meet their obligations in respect of the agreements reached at Rio in 1992 and at Kyoto in 1997. In March, 1998, the Chancellor of the Exchequer asked Lord Marshall of Knightsbridge (then the Chairman of British Airways) to head a task force on the subject of whether and, if so, how best to use new economic instruments to improve the industrial and commercial* use of energy and help to reduce emissions of Greenhouse gases.

*Note: *Lord Marshall's brief did not include the residential sector, despite the fact that it is a very significant user of energy, and especially in the case of the provision of space-heating and sanitary hot water.*

The main conclusions and recommendations in Lord Marshall's report (1998) included *inter alia* the points in the following *précis*:

1. All sectors – business, residential and transport - must play a part.
2. The commitments undertaken at Kyoto are only a start; the Government must also look to the future.
3. There is a role for economic instruments as part of a package of measures, which must protect both the competitiveness of British industry and the environment.
4. International trading in permits for the emission of Greenhouse gases should be in place by 2008 and will form part of the long-term solution. Any trading scheme will need robust monitoring and verification.
5. Even when such a trading system is established it is very unlikely to cover the majority of the business sector (i.e. the smaller companies); thus there is a role for a new environmental tax.
6. To protect competitiveness, the revenues of such a tax should be fully recycled to business, with some channelled into promoting energy-efficiency, etc.
7. The impact of the tax on the major energy-using industries should be abated.
8. The leading option is a tax on the final uses of energy by industrial/commercial users, **with the tax-rates reflecting the carbon content of different fuels.** [emphasis added]

In 1999 the Government, having considered Lord Marshall's report, introduced the Climate Change Levy (CCL) in preference to a carbon-based tax; it is believed that this was done to support the preservation of at least some role for coal as a fuel in the production of electricity.

6.4.2 The structure of the Levy.

The CCL is currently set at 0.43 pence/kWh for electricity (except for Green Electricity, which is exempted), and at the following rates for fossil fuels that are used for heating: 0.15 pence/kWh for gas, 1.17 pence/kWh for coal and 0.96 pence/kWh for liquid petroleum gas (LPG), **but zero for oil.** It is payable by all industrial, commercial, agricultural and public-administration users of these forms of energy (and *"other services"*) bodies, (**but not by residential users or charities).**

The exemption of residential consumers from CCL skews its effects, because such consumers use very substantial amounts of fossil fuels. Until the privatisation of the UK's electricity industry in 1989/90, no gas was used to make electricity in this country but, today, more electricity is generated from gas than from any other single type of fuel. But Government statistics (Hansard, 2004) show that residential consumers of gas generate a larger share (13 per cent) of the UK's total emissions of carbon than the electricity-generators who use gas (10 per cent), or other industrial users of gas (9 per cent).

Payment of CCL is made through bills for energy paid by industrial and commercial users, rather by the end-users, who are the general public. The proceeds from CCL are channelled to the Treasury, and are recycled to industrial and commercial taxpayers in the form of a reduction of 0.3 per cent in employers' National Insurance contributions.

Apart from the exemptions mentioned above, there are two categories of energy-users who benefit from special arrangements. Horticultural businesses pay CCL at half-rate. Large industrial energy-users can earn the right to pay CCL at the *"reduced rate"* of 20 per cent by undertaking environmental improvements negotiated with DEFRA.

The reason given by the Government for not imposing CCL on most mineral oils is that they are subject to the rules for Excise Duty. But **zero** Excise Duty is currently payable on heating-oil, and only 5 per cent of VAT is charged on deliveries of it to residential customers (thus, for wood-fuel, the level of taxation is the same as that for heating-oil in the UK). It is worth noting that another grade of oil - *"gas-oil"*, which is similar to heating-oil and is used as a fuel for farm-tractors and some machinery - **does** carry an Excise Duty of 5.22 pence/litre (about 0.5 pence/kWh) – increased by 1 penny/litre in the Chancellor of the Exchequer's pre-Budget statement of the 2nd December, 2004.

Incidentally, gas-oil is coloured with a red dye, and heating-oil with a yellow dye, so that they can be distinguished for taxing purposes from each other and from the diesel-oil that is used to power cars and lorries, which is not dyed, and which is taxed at a much higher rate (53.27 pence/litre).

Unfortunately, the large differential in taxes between gas-oil and diesel-oil has led to fraudulent removal of red dyes by criminals. In a recent speech, the Chancellor of the Exchequer gave this as his reason for increasing the Excise Duty on gas-oil.

The RCEP has repeatedly criticised the CCL, and called for a broader Carbon Tax on fuels, including those used for the generation of electricity, to be based on their carbon-contents, and for it to be applied so as to spread the base of tax-payers to include residential users of energy (Blundell, 1999).

CCL has been identified by the Conservative Party as one of the so-called *"stealth taxes"*. Presumably this criticism could not have been made if the CCL had been wholly recycled to its specific tax-payers.

The CCL may have helped some businesses; for example the *Financial Times* (FT) has reported (2001) that an increase in sales of wind turbines was linked to the fact that electricity generated from renewable sources would be exempt from CCL. But, despite (a) the provisions for the reduced rate, and (b) elements of recycling the receipts, CCL has always been, and remains very unpopular with most UK businesses: *"in light of the significant increases in energy prices being faced by industrial consumers"* the Confederation of British Industry (2004) called for *"… the rate of the CCL* [to] *be at the very least frozen in the 2005 Budget"*.

The FT reported on the effect of CCL on British Sugar, which had qualified for the reduced rate of 20 per cent, on the basis that the company would reduce its emissions of carbon dioxide from fossil fuels by 6 per cent by 2010. The company's Operations Director said that the *"company could have made greater carbon dioxide savings with no extra cost if the levy had been designed in a more logical way"*. British Sugar had invested £60 million in two gas-fired CHP plants that were more than twice as efficient as a typical coal-fired power station. But it found that, although gas brought on to the site would be eligible for relief from the CCL, any excess power that the company exported to the national grid would not be exempted. This acted as a disincentive for investing in such plants

Serious concerns were also expressed by smaller companies when the CCL was first introduced. The FT also noted that *"thousands of small and medium-sized companies will be hit and confused by the introduction of the energy tax. The levy will add between 10 and 20 per cent to the cost of electricity and gas for some commercial users, and comes on top of all ready steep price rises for gas and oil imposed in the last year."*

The FT also reported on the Hammond Heat Treatment company, which hardens steel components for the automotive industry, which was too small to qualify for the reduced rate. The company calculated that the CCL would increase the company's energy costs by £88,000 a year (more than £1,000 per employee), and that the recycling element of the Levy would return only £60 per employee per year.

Drs Mitchell and Woodman (2004) state that there is little information available on the levy's real impact, and argue that CCL's tax-rates should be doubled over the next five years, with matching cuts in employers' national-insurance contributions, to bring its effects in line with the Treasury's central estimate of £70 per tonne for the "*social cost*" of carbon (they state that CCL currently values carbon at £37/tonne).

6.4.3 Amending the Levy so that it covers mineral oils used for heating, and residential users of fossil fuels for heating.

All users of fossil fuels for heating are contributing to the problems associated with the depletion of resources and climate-change, but not to the same extent. Some are using much more such fuels than others, and some are using them less efficiently. Thus, the starting-point for possible amendments to the CCL should be a review of the possibility for it to be extended to produce a levy on the energy-content of **all** fossil fuels used for heating paid by **all** users of those fuels. The two key extensions are:

(a) inclusion of mineral oils used for heating, and
(b) inclusion of residential users of fossil fuels for heating.

In considering these two matters, it is important to check how they fit with other relevant legislation, beginning with the European Directive (2003/96/EC) that restructured the framework for taxation of energy products and electricity. This covers both matters, and indeed it sets out minimum rates of taxation to be applied to heating-fuels used by both business and non-business consumers.

Annex 1 of Directive 2003/96/EC contains a table (Table C, part of which is reproduced here as Table 5) that sets out minimum levels of taxation applicable to heating fuels and electricity.

Table 5. Minimum levels of taxation set by Directive 2003/96/EC that have been applicable since the 1st January, 2004 to gas-oil, kerosene and natural gas and electricity.

Fuel or electricity	For business use	For non-business use
Gas-oil – Euro/1,000 litres (pence/kWh)	21 (0.15)	21 (0.15)
Kerosene – Euro/1,000 litres (pence/kWh)	0	0
Natural gas – Euro/GJ (pence/kWh)	0.15 (0.03)	0.3 (0.06)
Electricity – Euro/MWh (pence/kWh)	0.5 (0.035)	1.0 (0.07)

At first glance, this suggests that there should be an energy-tax applied to the residential use of gas, but (in accordance with Article 15 (h) of the Directive), the UK has opted to exempt non-business users from such a tax.

Reference has already been made to the exclusion of mineral oils from CCL Excise. It is accepted that there may be technical reasons why the CCL cannot be applied to mineral oils because they are covered by the provisions for Excise Duty and, if these reasons cause problems that the Government considers to be insuperable then, instead, the Government should impose Excise duties on heating-oil at the same level as it would if those technical difficulties did not exist.

In parallel with extending the range of parties who are to be liable to pay CCL to include residential users of energy for heating, the Government should amend the relevant regulations to secure that:

(a) the proceeds of the extra Levy (and Duty, if appropriate) to flow from the residential sector should be deployed so as to encourage energy-efficiency;
(b) a part of the proceeds should be allocated to grants for the purchase of equipment selected from approved sources of technology;
(c) a second part of the proceeds should be allocated to protect the interests of the fuel-poor and other identifiable disadvantaged groups; and
(d) the remainder of the proceeds should be recycled (preferably *per capita*) to payers of Council Tax.

It seems sensible to arrange the division of the receipts so that a sum representing the total value of externalities (the Government's figure is £70/tonne of carbon) is allocated to Items (a), (b) and (c) in this list, and the remainder to Item (d).

It seems that the simplest way of collecting the Levy from residential customers will be to require the suppliers of fossil fuels for heating to add the Levy to bills (as they now do for VAT). The proceeds should then be passed to individual local authorities (perhaps *via* a central collecting agency that could simply re-allocate the funds according to the distribution of population), which will administer recycle the money as credits *via* the Council Tax. Thus there will be no need for the metering of heat or for the collection, validation or trading in Heat Certificates.

It might be argued that putting on a tax and then recycling part of it to tax-payers will not change behaviour, because the tax-payers will then simply use the recycled money to pay for part of the fuel-price increase. Perhaps some tax-payers might take that line but, if the terms are chosen carefully, others will not. Many owners and managers of properties that require significant quantities of energy for heating are well aware of their costs and, if they can securely cut those costs (in the context of a tax on fossil fuels) by applying energy-saving measures and/or changing to non-fossil fuels, some are very likely to do so. What is more, as the quantum of the proceeds of the tax available for recycling will be reduced as more and more people move away from fossil fuels, there will be a built-in pressure to act quickly. Good publicity for these points will be necessary, but the transfer of information by word-of-mouth will accelerate the take-up of the new opportunities.

Leaving aside the special extra arrangements to be made for capital grants and for disadvantaged groups, an important point is that the recycling process should be on a *per-capita* basis, regardless of how much (if any) CCL has been paid. Then, those people who implement measures (such as energy-efficiency or Green Heat) to avoid or reduce their payments of CCL will also share in the proceeds of other people's payments of CCL. If this point is not made clear, then the recycling process may be seen as a disincentive; but once it is understood, the reverse should become true, and recycling will then be seen as a doubling incentive to reduce the use of fossil fuels.

6.4.4 Setting more realistic rates for the extended CCL.

The main purpose of the CCL should be to alter people's behaviour so as to reduce their dependence on, and use of, fossil fuels. So far, the effect of the CCL on the totality of the UK's emissions of Greenhouse gases has been relatively small. Although major energy-users have embarked on specific improvements, the exclusions of mineral oils and residential users from the scope of the CCL until now have probably significantly reduced the chances of major and widespread changes in behaviour among users of fossil fuels for heating.

Even if the CCL is amended to include mineral oils and residential users, those changes might not be enough *per se* unless the rates of the Levy are set high enough to cause residential consumers to reduce their use of fossil fuels. As already noted, the Excise Duty on the *"red oil"* that is used in farm-tractors, etc. is about 0.5 pence/kWh. In the field of residential heating, the price of gas is currently about 1.6 to 1.8 pence/kWh, and the price of heating-oil is about 2.4 pence/kWh. Off-peak (*"Economy-7"*) electricity (which can be used in *"storage-heaters")* costs about 2.8 pence/kWh during the specified night-time hours*.

Note: tariffs for electricity vary between suppliers and, for some suppliers, between regions. The charges for the Economy-7 usually have three components: (a) units consumed during day-time hours – in the range of 6 to 8 pence/kWh; (b) units consumed during night-time hours – in the range from under 2.7 to about 3 pence/kWh; and (c) a standing charge of between 10 and 14 pence/day per separately metered installation. There is also "Economy 10"*, under which charges of 3.3 to 3.8 pence/kWh are made for the (longer) period of night-hours.*

Turning now to solid biofuels, some wood is available at very low prices. For example, some industries (e.g. joineries and furniture factories) have dry sawdust and shavings that have to be disposed of, and others (e.g. sawmills, tree-surgeons, etc.) have various green (= wet) wood residues, the coarser grades of which are usually chipped to facilitate their transport and disposal. Some such wastes/residues find their way as raw materials into other industries (e.g. agriculture, particle-board manufacture, etc.); traditionally, the rest has gone to landfill, but there is pressure arising from the implementation of the Landfill Directive for that to cease. That pressure also applies to the disposal of contaminated (treated, painted, etc.) wood. Thus there is interest in using some of these residues/wastes into fuels. The price of them depends on such obvious variables as (a) supply and demand and (b) the specification required.

It is possible to find supplies of higher-grade wood-fuels, such as wood-chips to a given specification controlling, for example, moisture-content and particle-size distribution, or wood-pellets, in price-ranges in bulk from about 1.3 pence/kWh for wood-chips and from about 2.2 pence/kWh for pellets (depending on the scale of purchases and delivery-range, etc.), but the extra costs of the equipment required to burn these at high levels of efficiency, and the ancillaries for storing and feeding the fuel, etc., often make changing from oil to wood-fuel unattractive from a financial point of view, unless there is a capital grant for which the customer is eligible.

And, in the case of the users of gas, the current rate of CCL on gas at 0.15 pence/kWh (which is anyway levied only on business customers) is insufficient to persuade many users of gas to change to Green Heat.

FoE *et al.* (2004) have suggested that the buy-out price for HOCs should be set at £10/MWh (1 penny/kWh). In a short market (if the same rules as for ROCs were followed), the traded values would be substantially higher, and it might be this indicator that would drive the market at the margin.

As part of this study, an investigation is being made of the level(s) of CCL/Duty that would lead to investment in various forms of Green Heat (biomass, heat-pumps, solar-heating), and at various scales by various parties. The results of this work will be contained in Volume 3 of this report.

If the Government is prepared in principle to implement an improved version of the CCL (perhaps coupled with changes to Excise Duties) to cover residential customers and mineral oils, it will also be worthwhile to propose increases in the rates levied on industrial and commercial users of fossil fuels above their current levels. In that case, it would be important again to secure the **full** recycling of those proceeds by a carefully designed process that again incentivises Green Heat and energy-efficiency. That will provide an answer to fears about loss of competitiveness, but still give the incentive for real progress in reductions in the use of fossil fuels. That recycling might best be done through the Business-Rates mechanism.

6.4.5 Implementation of the changes.

It can be expected that the rules for the amended CCL would be enacted by Parliament using some primary legislation, together with periodic Orders by the Secretaries of State, etc. Resources would be needed to harmonise the passage of bills, etc., through the several independent legislatures in the UK.

The tax-rates selected for the initial phase of the amended Levy should be set at levels that can reasonably be expected to have the immediate effect of making residential energy-users act more responsibly, encouraging them to invest in energy-saving and energy-efficient habits. But the Government should announce its intention to use this measure into the future to continue to achieve the use of fossil fuels, and should set out clearly the annual increases that it expects to make to the tax-rates. This will remove uncertainty about future prospects and hence allow people to weigh their investment-decisions sensibly.

Such a system, if carefully designed and implemented, could have the prime advantages, compared with a Heat Obligation of: (a) being easier and much less bureaucratic to implement and to manage; (b) being more secure against evasion and/or fraud, (c) having lower setting-up and operating costs, and (d) and rewarding every valid action to reduce the use of fossil fuels for heating.

The arrangements for the disbursement of the proceeds of the Levy could be arranged to allow due account of the need to address fuel-poverty. For example, applying a flat rate (£/year/*per capita*) for the rebate on Council Tax could work towards that aim. Some improvement to the Winter Fuel Allowances should also be considered.

For payers of Business Rates, however, such considerations do not apply, and thus rebates would better be applied on a different basis, perhaps in relation to the areas of land occupied by commercial premises.

6.4.6 Who will support, and who will oppose, the amended Levy?

It has to be faced that a substantial number of the general public, especially those connected with agricultural, road-transport and similar or related industries, are in a state of mind to oppose, on what they see as principle, **any** increases in taxation on fuels. That attitude stems from a policy, introduced by a previous Administration, to increase each year, at a rate above that of inflation, the level of Excise Duty payable on vehicle-fuels. On one occasion, protests against this measure became organised country-wide and threats of civil disobedience were made; the Government then halted the rate of increase, using increases in the price of crude oil as their reason..

In view of this known ingrained opposition to increased taxation on fuels, it is therefore vital that the amended Levy is carefully designed, and even more carefully explained to the general public. The features suggested herein, especially the intention that part of the proceeds of the amended Levy should be recycled through Council Tax and Business Rates, could play an important role in gaining broad acceptance. But there must be a credible connection between (a) the introduction of the amended Levy, (b) the establishment and adequately rapid growth of Green Heat in the UK up to a significant level, (c) cost-saving, energy-saving measures, and (d) support for the fuel-poor.

Advantage should be taken of the fact that, within what might be called the moral leadership of the UK, there is a rising tide of enthusiasm for positive action on sustainability and climate-change. Recent speeches on the subject have been made by Her Majesty the Queen and the Archbishop of Canterbury. The enthusiasm of HRH the Prince of Wales for action in this area is also well known.

The Prime Minister and many other politicians of all parties, both at the European and national levels, have all made speeches about the importance of action on renewables. As has been shown above, however, progress in the UK has been quite slow. Supporting Green Heat could offer a step-change in progress towards the Government's targets at relatively less cost than further support for Green Electricity.

The civil servants at DTI and DEFRA who are committed to review this subject, might support an amended CCL as it is envisaged herein, because it is an extension of already existing financial instruments; (b) it is probably defensible at the European level; (c) it can be shaped to be coherent with other policies, and (d) its introduction does not require the dismantling of other arrangements

In this context, it is important to note that DTI and DEFRA have recently let a research-contract to Future Energy Solutions Ltd (formerly ETSU) for a study of the market for heat; in taking forward the campaign for support for Green Heat it will be useful to interact with those researchers. Coincidentally, DEFRA has issued a consultation-paper (2004) on its review of the UK's climate-change programme, and that specifically invites comments on *inter alia "… the potential for using biomass as a renewable source of energy"* and *"what contribution can renewable heat make to our emission-reduction goals and how?"*.

It might be thought that the large suppliers of fossil fuels will automatically lobby against a widened and strengthened form of the CCL, but it is worth noting that, in its first report (2004) on the success of the D-RES-E, the EC states *"Within a framework of Community legislation in place, it is to Member States that responsibility falls for ensuring that the agreed targets and measures are, in fact, implemented on the ground. This will require a wide range of national actions, including efforts to ensure that established firms in the energy supply industries pay a share of the costs of promoting renewable energy."* and *"the established energy-supply industries have an income of over 200 billion Euros a year in EU15 alone and are often able to earn high levels of profit. In 2001, the Commission's Green Paper suggested that profitable energies such as oil, gas and nuclear energy could finance the development of renewable energy sources which, unlike traditional energy sources, have not benefited from substantial support. It is time for all Member States to put this idea into practice"*. So the large suppliers of fossil fuels are already on notice that, if targets for Green Energy are not met, they are likely to be subjected to costly changes in legislation.

In fact, there are signs that some of those companies are already taking positive actions in this field. For example, British Gas is offering a system under which householders can get a rebate on their Council-Tax bills by making green improvements to their homes (Utility Week, 2004). And large oil-companies have invested in new businesses based on Green Energy (biomass, solar heating, photovoltaics, etc.). Electricity companies in the UK have become familiar with the RO and some of them are probably also interested in the future market in Green Heat (in some other European countries, some utility-companies supply both electricity and heat)

6.5 Value Added Tax.

XXX INSERT NOTE ON REDUCED-RATE VAT FOR GREEN HEAT TECHNOLOGIES (SEE MESSAGE TO SANDRA HAYES AT NEF)

7. CONCLUSIONS.

To promote Green Heat while also promoting energy-efficiency, there should be amendments made to the CCL (and possibly to Excise Duty) so that it/they cover (a) **all** fossil fuels, including mineral oils; (b) **all** uses, including heating; (c) **all** customers, including residential users. These changes should be made in such a way to promote energy-saving.

Part of the proceeds of the revised CCL should be used to pay capital grants to those who purchase approved equipment so that they can install Green Heat devices. Another part of the proceeds should be used to make special arrangements for the fuel-poor and other disadvantaged groups.

The balance of the proceeds should be recycled to taxpayers. In the case of residential taxpayers, this should be done through the Council-Tax mechanism and, for commercial businesses and industry, it should be achieved through the Business-Rate mechanism.

Great care will be needed in formulating and implementing the changes to the CCL, so that it will:

(a) secure real progress towards the growth of Green Heat in the UK;
(b) be seen to be fair and reasonable;
(c) be simple, secure and low-cost in operation;
(d) not increase the general burden on taxpayers at large; and
(e) take account of the sectors of society that needs special consideration.

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